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EARLY TERTIARY VERTEBRATE FAUNAS  
BIG BEND AREA TRANS-PECOS TEXAS:  
BRONTOTHERIIDAE

by

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ABSTRACT

A new larger species of *Sthenodectes* is based on two well preserved skulls and other material from the late Bridgerian or early Uintan (middle or late Eocene) of the Agua Fria area in Trans-Pecos Texas. *Menodus bakeri* Stovall is confirmed from the Porvenir and Little Egypt local faunas (Chadronian) (early Oligocene) of the Vieja area in Trans-Pecos Texas.

INTRODUCTION

Remains of titanotheres are fairly common in the Vieja Group west of Marfa, Texas and in the Buck Hill Group northwest of Big Bend National Park, Texas. Partial dentitions and limb bone fragments are found most frequently, and skulls and jaws are rare. The purpose of this article is to continue reporting on the Eocene and Oligocene vertebrate fossil faunas of the Sierra Vieja area and to supplement this, where possible, with additional material from the Eocene of the Agua Fria area.

PREVIOUS WORK

The first Oligocene titanothere material was collected from the Vieja Group and reported by Stovall (1948). More was collected by Bryan Patterson and J. H. Quinn from the same general area for the Field Museum of Natural History, Chicago, in 1949. Wilson (1967) described the first Eocene titanothere material, a tooth fragment, as Brontotheriidae genus indet. from the Canoe Fm., Bridgerian, Big Bend National Park. Ferrusquia V. (1969) described a partial skull identified as *?Brontops* cf. *B. brachycephalus* from the Rancho Guitan local fauna, Chadronian, just across the Rio Grande in northeastern Chihuahua, Mexico. In faunal lists (Wilson et al., 1968) and in guidebooks of the area the informal designation "titanothere" is used. Enough good material has accumulated during the last few years to warrant this description.

Earlier publications, especially Stovall (1948), DeFord (1958), and Wilson et al. (1968), discuss the location, previous work, stratigraphy, and age of the Vieja Group. Wilson (1972, 1974) and Wood (1973) describe the vertebrate fossil occurrence in the Pruett Fm. of the Buck Hill Group. Wilson

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(1967) describes the occurrence of early Tertiary fossils from Big Bend National Park. Repetition is not felt necessary at this time.

### Abbreviations

alv.	measurement across alveolus
AMNH	American Museum of Natural History, New York
CM	Carnegie Museum, Pittsburgh
FMNH	Field Museum of Natural History, Chicago
IGM	Instituto de Geologia, Universidad Nacional Autonoma de Mexico
L	greatest anteroposterior length
l.f.	local fauna
MG	Museum of Geology, South Dakota School of Mines and Technology, Rapid City
OU	Stovall Museum, University of Oklahoma, Norman
TMM	Texas Memorial Museum, The University of Texas at Austin
W	greatest labiolingual width

Specimen numbers without prefixes belong to TMM. All measurements are in millimeters. Detailed descriptions of localities are on file at the Vertebrate Paleontology Laboratory. This paper is a contribution of the Vertebrate Paleontology Laboratory, Texas Memorial Museum, The University of Texas at Austin.

### Acknowledgments

The Geology Foundation and the University Research Institute of The University of Texas at Austin and NSF grants C13270 and CP 1050 have contributed to the support of the field work, the laboratory preparation, and the cost of publication. Mr. and Mrs. Howard Gibson of Fort Davis, Texas generously donated to the university the titanotheres material they had collected from the Vieja area. I appreciate the cooperation of the members of the administrative staff, Big Bend National Park, and of the local ranchers, in particular Mr. and Mrs. Billie Pat McKinney of the Agua Fria Ranch.

Two Eocene and one Oligocene skull were found by Margaret S. Stevens who also made the line drawings.

## SYSTEMATIC PALEONTOLOGY

### Order Perissodactyla Family Brontotheriidae

A fragmentary premolar, TMM\* 40146-1, illustrated by Wilson (1967) was collected from the Canoe Fm. about 525 feet above the base of the Big Yellow Ss. Member which is the basal member of the Canoe Fm. Since that time, another premolar fragment, 40145-5, has been found in the Big Yellow Ss. Member at the "Canoe" locality (Maxwell et al. 1967, Pl. 2). A third premolar fragment, 41443-615, has been found in the "basal Tertiary conglomerate" of the Pruett Fm. in the Agua Fria area (Moon 1953, Pl. 1). The latter two fragments represent the oldest occurrences of titanotheres in the Big Bend area of Texas. The fragment from the Big Yellow Ss. Member is associated with *Hyrachyus* sp. The fragment TMM 40146-1 was associated with *Helohyas* cf. *H. lentus*, an upper Bridger form (Gazin 1976). The premolar fragment from the Agua Fria area is associated with the rodent fauna described by Wood (1973) as Bridgerian and by me (Wilson 1974) as early Uintan. Better material from these lower levels is needed before more can be said concerning their identification.

### Subfamily Telmatheriinae Osborn, 1914 Genus *Sthenodectes* Gregory, 1912

Late Eocene titanotheres with advanced premolar dentition, large molar teeth of Oligocene proportions, massive jaws, very low nasal horns, large canines.

### *Sthenodectes australis*\*\* new species

Whistler Squat l.f. and probably Candelaria l.f.

Figs. 1, 2, 3; Tables 1, 2

*Type*—TMM 41723-3, a skull with right C-M<sup>3</sup> and left P1-M<sup>3</sup>.

*Referred Material*—TMM 41723-6, skull with right and left P1-M<sup>3</sup>, titanotheres channels, titanotheres hill; 41466-6, M<sup>2</sup>, Whistler Squat quarry level; 41578-10, poorly preserved maxillary with partial M<sup>3</sup>, skyline conglomerate.

\*This collection and the Vertebrate Paleontology Laboratory were formerly under the administrative control of the Bureau of Economic Geology, University of Texas. Older acronyms BEG or UTBEG are superseded by TMM for Texas Memorial Museum, The University of Texas at Austin.

\*\*In allusion to its southern range.



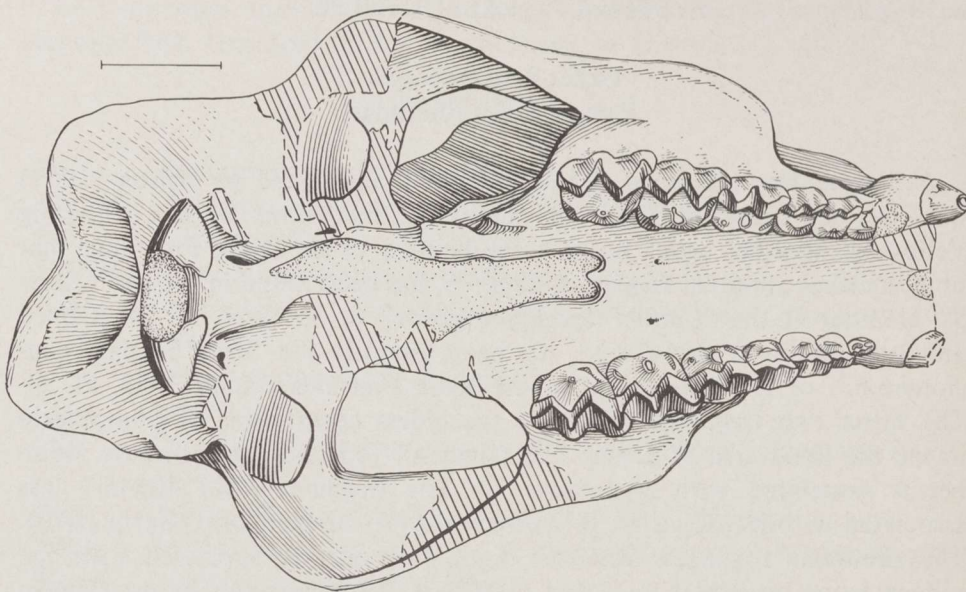


Fig. 1.—*Sthenodectes australis* n. sp., type, TMM 41723-3. Skull with right C-M<sup>3</sup>, left P<sup>1</sup>-M<sup>3</sup>. Palatal view. Whistler Squat l.f., early Uintan, Pruett Fm. Length of bar 8 cm.

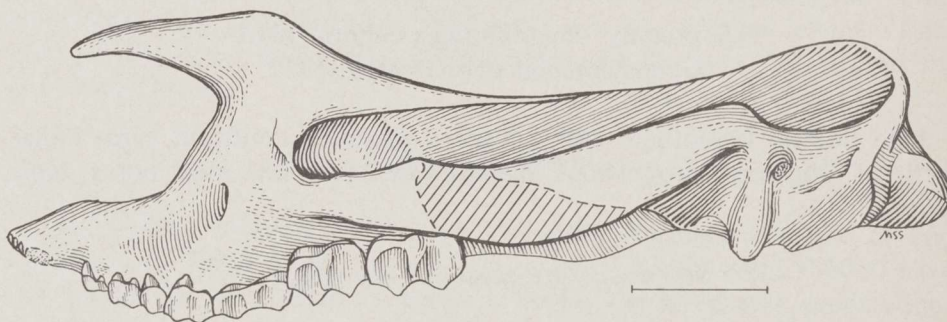


Fig. 2.—*Sthenodectes australis* n. sp., type, TMM 41723-3. Skull left side, somewhat crushed and not restored in drawing. Whistler Squat l.f., early Uintan, Pruett Fm. Length of bar 8 cm.

erate,\* Teepee Canyon; 41715-6, right ramus of lower jaw with partial P<sup>2</sup>-4 and M<sup>1</sup>-3. Less certainly referred 40113-2, right ramus of lower jaw with P<sup>3</sup>-4, M<sup>1</sup>-2, M<sup>3</sup> not erupted, Cottonwood Tank; 31281-17, right ramus of lower jaw with fragmentary M<sub>2</sub> and M<sub>3</sub>, mouth of Capote Creek Candalaria l.f.

*Stratigraphic distribution*—The type is from the “titanotheres channels” approximately 150-200 feet above the base of the Pruett Formation. The lowest occurrence of *S. australis* is the M<sup>3</sup>, 41466-6, that was found below the Whistler Squat quarry level and above the “variegated layer” in the lower

\*The stratigraphic position of informal units for the Agua Fria area is in press.

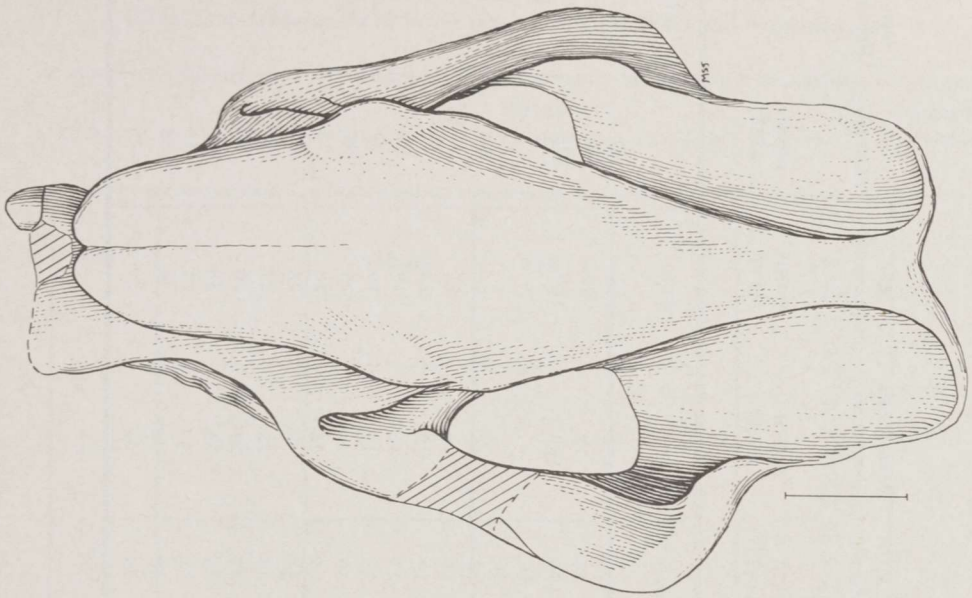


Fig. 3.—*Sthenodectes australis* n. sp., type, TMM 41723-3. Skull, top view. Whistler Squat l.f., early Uintan, Pruett Fm. Length of bar 8 cm.

part of the Pruett Formation. The highest occurrence in the same formation is the maxillary, 41578-10, and the lower jaw, 41715-6, which were found in the "skyline channels" approximately 400 feet below the Mitchell Mesa Rhyolite. A lower jaw, 31281-17, from the Candelaria local fauna is from within 50 feet of the base of the Colmena Tuff.

*Age*—Early Uintan, Whistler Squat local fauna; Uintan, Myton, Candelaria l.f.

*Description*—Skull moderately brachycephalic. Horns present but rudimentary; more prominent on the type than on 41723-6. The base of the horns appears to be on the nasal bones although I cannot be certain because the sutures are not clear. Both skulls are partly crushed and give the appearance of having an infraorbital protuberance, but if the effect of the crushing were removed, such a protuberance would probably not have been more prominent than in CM 2398 as figured in Osborn (1929, fig. 301) or in FMNH 12168 (Osborn 1929, pl. LXVI). The skull is large (table 1) and the teeth in proportion to the skull length are very large, almost as large as those of Oligocene titanotheres.

The premolars are advanced like *Telmatherium*, with only a single internal cusp on each. There are two distinct external cusps on the P<sup>1</sup>, which is also an advanced character. The wear on P<sup>1-4</sup> forms the molariform pattern. On P<sup>1</sup> an internal ridge extends approximately parallel with the ectoloph and curves posteroexternally to join the ectoloph at the posterior margin of the tooth. This makes a molariform pattern on P<sup>1</sup> that is more advanced than



Table 1. Measurements of skull and upper dentition of *Sthenodectes*, *Telmatherium*, and *Mantoceras*

	<i>Sthenodectes</i> <i>australis</i> n. sp.	<i>S.</i> <i>australis</i> n. sp.	<i>S.</i> <i>australis</i> n. sp.	<i>S.</i> <i>australis</i> n. sp.	<i>Telmatherium</i> <i>ultimum</i> <sup>1</sup> , Type	<i>S.</i> <i>incisivus</i> <sup>1</sup> , Type	<i>S.</i> <i>incisivus</i> <sup>1</sup> , Type	<i>S.</i> <i>incisivus</i> <sup>2</sup> , Type	<i>S.</i> <i>priscus</i> <sup>4</sup> , Type	<i>Mantoceras</i> <i>mantoceras</i> <sup>3</sup> , Type	<i>M.</i> <i>mantoceras</i> <sup>3</sup> , Type	<i>M.</i> <i>uintensis</i> <sup>3</sup> , Type	<i>Notiotitanops</i> <i>mississippiensis</i> <sup>5</sup> , Type
	TMM 41723-3	TMM 41723-6	TMM 41578-10	TMM 41466-6	AMNH 2060	CM 2398	FMNH 12168	FMNH 12168	CM 11437	AMNH 12683	AMNH 1511	AMNH 2388	USNM 16646
Basilar L	531	555			500	490	488	460	415		447		560
Zygomatic W	385				300+	310@	305	300					
p1-M <sup>3</sup>	232	237	p2-M <sup>3</sup> 241		218	207	211	311	198	176	184	240	229
p1-p4	82	92@			89	84			58	79	82	101	90.7
M1-M <sup>3</sup>	156	149	169 est		130	125	132	132	124	100	104	138	147
C L	28.5				25	27			26				27
W	28				23	27			26				24
p1 L	16.6	17.3							16	15	16	24	17.2
W	14.4	16							11	8	11	11	13.2
p2 L	21.5@	23.5							19	18	22	21	
W	24	24.6							23	16	19	20	
p3 L	25	26.8@			23				23	17	19	24	26.2
W	31@	28			32				30	21	25	29	30.9
p4 L	30@	28.5@			25	23			23	20	20	26	
W	36.5	38.2			34	29			34	26	28	32	
M1 L	42.7	46.5			39	40			34	28	27	40	43.5
W	44.3	42.1			36	44			42	29	30	38	42
M2 L	59.5	57.6	64.1	65 est	45	45			43	35	38	52	
W	53.2	50.5			46	49			51	37	37	46	
M3 L	65.3	61.9	69.4		44	41			48	36	39	45	58.0
W	58.0	54			51	46			49	39	39	50	56.5

1. Osborn 1929, p. 357

2. Riggs 1912, p. 39

3. Osborn 1929, p. 364

4. Peterson 1934, pp. 360-361

5. Gazin and Sullivan 1942, pp. 12-13



Table 2. Measurements of lower jaws of *Sthenodectes* and *Notiotitanops*

	<i>S. australis</i>	? <i>S. australis</i>	? <i>S. australis</i>	<i>S. incisivus</i> FMNH	<i>S. australis</i>	<i>S. priscus</i> <sup>1</sup>	<i>Notiotitanops</i> <i>mississippiensis</i> <sup>2</sup>
	41715-6	40113-2	31281-17	12166	41466-10	CM 11437	USNM 16646
M <sub>1</sub> -M <sub>3</sub>	160	—	160 est	130		132	155
P <sub>1</sub> L		—				17	
W		—				10	
P <sub>2</sub> L		—				21	
W		—				15	
P <sub>3</sub> L	—	35.4			30.8	21	25.6
W	—	21.0			18.5	18	19.2
P <sub>4</sub> L	28.7	37.8				25	—
W	21.3	26.3				21	—
M <sub>1</sub> L	37.9	55.5				33	30.0
W	25.0	30.2				25	26.7
M <sub>2</sub> L	50.2	62.9				41	—
W	30.5	33.2				30	—
M <sub>3</sub> L	73.2	—	79.5@			58	69.2
W	34.5	—	33.9@			29	31

1. Peterson 1934, p. 361

2. Gazin and Sullivan 1942, p. 13

in *S. incisivus* (Riggs 1912, pl. 12). There is a faint external cingulum on P<sub>4</sub> and none on P<sub>1</sub>-3.

The molar teeth are very large. The mesostyles of the upper molars are not compressed as in the *Telmatherium*. There are two internal cusps on M<sub>1</sub>-2 and only a single internal cusp on M<sub>3</sub>. All the upper molars have prominent anterointernal cingula and a moderately well developed cingulum between the para- and metastyles.

The type, 41723-3, and the second skull, 41723-6, are the most complete specimens but neither has an associated lower jaw. A poorly preserved right upper dentition, 41578-10, was collected from the upper red sandstone "skyline" channels. Wilson and Szalay (1976, p. 296) discuss the age of these channels. The length of the tooth row and the approximate size of the teeth show that this partial skull is close to *Sthenodectes*. A lower jaw, 41715-6, from approximately the same stratigraphic level is also referred to as *Sthenodectes* for the reason that although the teeth are almost as large as those from the Porvenir l.f. the jaws are smaller and less robust. A single exception is 40113-2, which does not yet have M<sub>3</sub> erupted and has a very large M<sub>1</sub> and M<sub>2</sub>. The stratigraphic position of the locality from which this jaw came is uncertain. The locality is isolated from presently known sections but is known to be below the Cottonwood Spring Basalt which marks the top of the Pruett Formation.

In identifying the Texas Eocene titanotheres, I have emphasized the very large molars in proportion to skull length, the advanced condition of the premolars, and the very rudimentary horns. This set of characters seems to best fit *Sthenodectes*.

Subfamily Menodontinae  
Genus *Menodus*  
*Menodus bakeri* Stovall, 1948

Fig. 4, Tables 3, 4

*Type*—OU 18-4-S17, lower jaw with right C, P<sub>2</sub>, P<sub>3</sub>, fragmentary P<sub>4</sub>-M<sub>1</sub>, M<sub>3</sub>, left M<sub>1</sub>-M<sub>3</sub>; from lower part of Chambers Tuff, Presidio County, Texas. Porvenir l.f.

*Referred material*—OU 19-2-S8, fragmentary dP<sub>2</sub>, dP<sub>3</sub>, dP<sub>4</sub> (identified as M<sub>1</sub>-2 in Stovall 1948, fig. 8); OU 19-2-S8, P<sub>2</sub>, P<sub>3</sub> (the figure caption reads "*M. bendi*" in Stovall 1948, fig. 9, but see below); OU 18-26-S3, right M<sub>3</sub>; TMM 40206-3, fragmentary lower jaw with P<sub>2</sub>, P<sub>3</sub>, and fragmentary M<sub>2</sub>; 40203-44, left M<sub>2</sub> and numerous fragmentary teeth and limb bones all from the lower part of the Chambers Tuff, Porvenir l.f. In addition, there is a collection of titanotheres remains also from the lower part of Chambers Tuff at the FMNH, which is unstudied. TMM 40840-39 skull with poorly preserved dentition; 40840-38, lower jaw with right P<sub>2</sub>-P<sub>4</sub> fragmentary, M<sub>1</sub>-3, left C, P<sub>2</sub>-P<sub>4</sub> fragmentary M<sub>2</sub>-3; 40804-1, an articulated right forelimb, scapula to manus; 40209-634, right dP<sub>2</sub>-dP<sub>3</sub>, all from Little Egypt l.f., upper part of

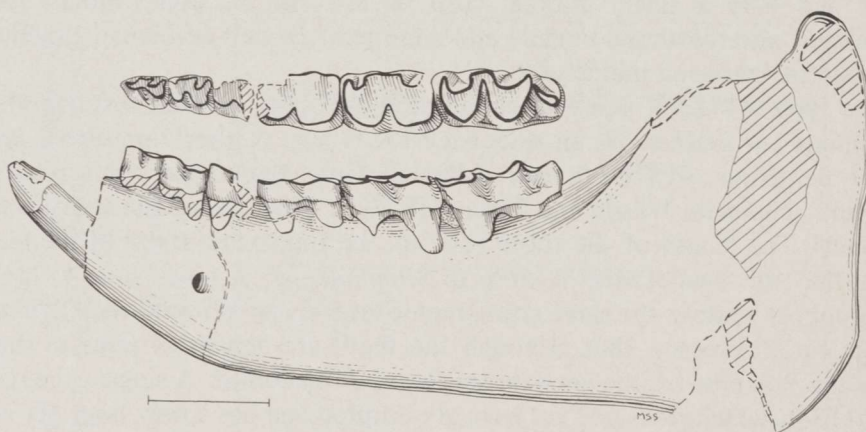


Fig. 4.—*Menodus bakeri* Stovall, type OU 18-4-S17. Lower jaw with right C, P<sub>2</sub>, P<sub>3</sub>, fragmentary P<sub>4</sub>, M<sub>1</sub>-M<sub>3</sub>; left M<sub>1</sub>-M<sub>3</sub>. Lower jaw, left side with C and P<sub>2</sub>-4 reversed from right side. Porvenir l.f., early Chadronian, Chambers Tuff. Premolars 2 and 3, OU 19-2-S8, are restored to their proper positions. Length of bar 8 cm.



Table 3. Measurements of skull and upper dentition of various early Oligocene titanotheres

	<i>?Menodus bakeri</i>	<i>?M. bakeri</i>	<i>?M. bakeri</i>	<i>?M. bakeri</i>	<i>M. haloceras</i> <sub>1</sub> , TMNH	<i>M. haloceras</i> AMNH	<i>Teleodus uintens</i> <sub>2</sub> , CM	<i>T. thyboi</i> CM	<i>T. thyboi</i> MG	<i>T. thyboi</i> MG	<i>?Brontops cf. B. brachycephalus</i> <sub>2</sub> , IGM 65-29	<i>B. brachycephalus</i> GSC
	40932-1	40209-634	40203-44	31074-1	6360	13467	11754	11759	63690	63689		8809
Basilar L	565					603	523	508				534
Zygom. W	385				395	450	354	289			462. est	356
L-M <sup>3</sup>	332 est											
P <sup>1</sup> -M <sup>3</sup>	305.6 est					265@	268	232				
P <sup>1</sup> -P <sup>4</sup>	115 est						94	95				108
M <sup>1</sup> -M <sup>3</sup>	190 est					170	174	141			177	169
I <sup>2</sup> alv.	7.2											
I <sup>3</sup> alv.	10.0											
C L alv.	26.8						22	19				
W alv.	25.0											
P <sup>1</sup> L							14	14.5				16.2
W							13	14				15.4
P <sup>2</sup> L	31.8	dp <sup>2</sup> L 39.0					21	20	22.5		20	25.7
W	35.8	W 30.2					26.5	24	24.6		28	30.5
P <sup>3</sup> L	35.3@	dp <sup>3</sup> L 47.3@					26	25	26.8	26.5	31.5	33.1
W	46.7	W 35.7					32	30	29.5	31.4	35	40.0
P <sup>4</sup> L	45.0						35	28		33.8	31	35.9
W	54.9						39	35		39.9	37	49.0
M <sup>1</sup> L							46	34		46.3	49.5	50.5
W							45	38		45.8	49	51.3
M <sup>2</sup> L							61	50		57.6	64	68.4
W							53	56		57.4	59	62.8
M <sup>3</sup> L			69.4	73.5@			65	56		60.4	64.2	68.8
W			70.8	77@			61	56		57.1	59	66.7

1. Osborn 1929, p. 525

2. Scott 1945, p. 245

3. Bjork 1967, p. 232

4. Ferrusquia 1969, p. 109

5. Russell 1940, p. 92

Table 4. Measurements of lower jaws and teeth of *Menodus bakeri*

	40840-38	40206-30	40062
C-M <sub>3</sub>	291		
P <sub>1</sub> -M <sub>3</sub>			
P <sub>1</sub> -P <sub>4</sub>			
M <sub>1</sub> -M <sub>3</sub>			
P <sub>1</sub> L			
W			
P <sub>2</sub> L		25.2	31.0
W		—	21.1
P <sub>3</sub> L		31.6	35.1
W		—	25.6
P <sub>4</sub> L			39.0
W			32.0
M <sub>1</sub> L			53.0
W			35.8
M <sub>2</sub> L	57.5		
W	32.4@		
M <sub>3</sub> L	80.7		
W	31.5		

Chambers Tuff. Of questionable reference is TMM 40932-1, uncrushed skull with left I<sub>2</sub>-3, C, P<sub>2</sub>-4 (fig. 5), middle part of Chisos Formation, Smoky Creek, Big Bend National Park, Texas.

*Stratigraphic position*—Titanotheres material is found in the Chambers Tuff in both the lower and upper parts; the collection at the Field Museum in Chicago came from the lower part. Most but not all of TMM material is from the upper part of the Chambers Tuff from a red sandstone at the approximate position of the Bracks Rhyolite. Weathered fragments of large bones, probably titanotheres but possibly *Metamynodon* are found in the Capote Mountain Tuff approximately 570 feet above the Bracks Rhyolite. In addition, titanotheres material, enamel fragments, and lower jaw fragments are known from the Ash Spring l.f. (Harris 1967a, 1967b, and Harris and Wood 1969), which is the highest stratigraphically in the uppermost part of the Vieja Group undifferentiated.

*Age*—Chadronian.

*Description*—Stovall (1948, p. 89) described the new species *Menodus bakeri*. He states, "At one location we collected a lower jaw, which lacked only the incisors of being complete, about 12 vertebrae, several damaged ribs, an almost complete femur and a few foot and toe bones." He only de-



scribes the lower jaw, however, and figures it on his plate 1, fig. 7. Several vertebrae and a humerus are present in the University of Oklahoma collection, but all bear different catalog numbers than that of the lower jaw. Stovall did not designate a type specimen, so I have assumed that prerogative and designated the lower jaw he described, OU 18-4-S17, as the type.

Stovall in the same paper described and figured two more specimens of titanotheres. His figure 8 illustrates what he identifies as "Portion of maxillary with M<sup>1</sup> and M<sup>2</sup> and a portion of P<sup>4</sup> of an unidentified titanotheres.

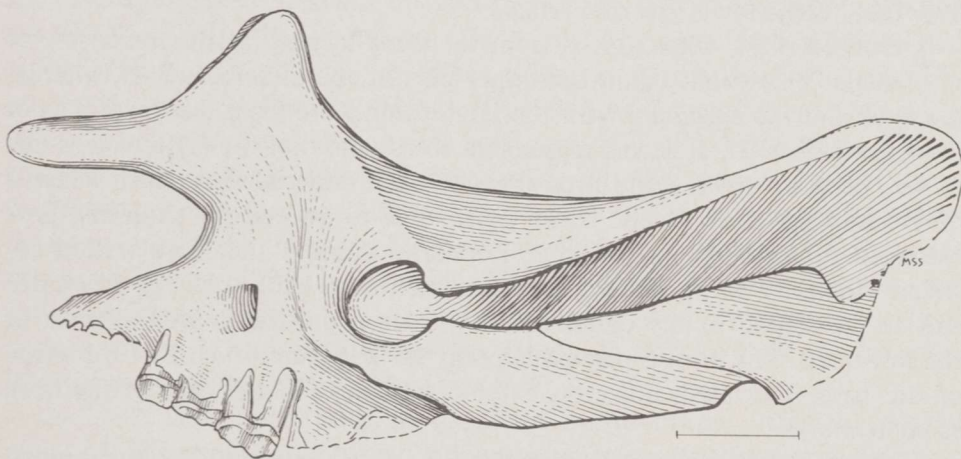


Fig. 5.—?*Menodus bakeri*, TMM 40932-1. Skull, left side. Early Chadronian. Chisos Fm. Big Bend National Park. Length of bar 8 cm.

Portion of maxillary and teeth. Antero-posterior diameter of M<sup>2</sup> 46 mm., width 44 mm., M. U. O. No. 19-2-S8." This specimen is easily recognizable in the collection, but it bears a red star and has a tray label as being the type of *Microdonta bendi*. This name, at least part of it, is used by Stovall in the caption for his fig. 9, which reads: "P<sub>2</sub> and P<sub>3</sub> of *M. bendi* gen. et sp. nov. Length of P<sub>2</sub> 27 mm. Length of P<sub>3</sub> 32 mm. M.U.O. No. 19-2-S8." Similarly, these two teeth are easily recognizable from the drawings, although they now bear different numbers. *Microdonta bendi* is obviously a *nomen nudum*. The two upper teeth, I believe, are part of the milk dentition, which accounts for their small size. The P<sub>2</sub> and P<sub>3</sub> figured by Stovall in his fig. 9 (and identified as *M. bendi* gen. et sp. nov.) fit onto the lower jaw, herein designated the type of *Menodus bakeri*. The lower jaw, OU 18-4-S17, is refigured and shown somewhat diagrammatically with the premolars reversed. Although Stovall (1948) showed two recumbent canines in his fig. 7, only one could be found in the collection. It had been broken off but fitted perfectly when the jaw was repaired.

As Stovall (1948) mentioned, the most distinctive character exhibited by the lower jaw is the large recumbent canines and it was this that led him to describe the new species. The same character is present in TMM 40206-30. The root of a very large canine, not quite as recumbent as that in the type,

is present. Posterior to the dorsal edge of the alveolus for the canine is a diastema 43.5 mm. long. Another lower jaw fragment, TMM 40062, has part of the alveolus for the canine preserved. It also is large and recumbent. This is apparently a unique condition among Oligocene titanotheres and so I regard Stovall's (1948) description of *M. bakeri* as valid.

Another lower jaw, TMM 40840-38, has a much smaller canine that is in the erect position. The proportions of the cheek teeth are similar to those from jaws with the large canines, so I am assuming that the former, TMM 40840-38, is the lower jaw of a female.

A crushed skull, 40840-39, is from the same locality as the lower jaw of the female. The locality is in the upper part of the Chambers Tuff, whereas the type and the specimen with the large canines are from the lower part of the Chambers Tuff. It seems reasonable to assume that the difference is one of sex, because the size and proportions of the material from both levels is otherwise very close. It also seems reasonable to assume the skull and jaws belonged to members of the same population, and I therefore tentatively assign 40840-39 to *M. bakeri*. This specimen is so badly crushed it is difficult to describe it in any detail. The left horn is present as well as most of the left nasal. The horn is rotated laterally so that I am not sure of the shape of the base. The nasal, however, extends well beyond the base of the horn as in *Menodus*.

A much better preserved skull, 40932-1, was collected by Margaret S. Stevens in the Chisos Formation in Big Bend National Park. The locality is FL 17 on Plate 1 in J. B. Stevens (1969). The skull was found in a conglomerate that occurs in a down-faulted block. The conglomerate is overlain by the Tule Mt. Trachyandesite Member of the Chisos Formation. The lower contact of the conglomerate is against a fault on the other side of which are Miocene sediments. It is, therefore, not possible to state which unit within the Chisos Formation underlies the titanotheres-bearing conglomerate.

The skull was tentatively identified by me as *?Brontops* sp. in J. B. Stevens (1969, p. 22). After the closer comparison with the titanotheres material from the Vieja area, I feel that the titanotheres from the two areas are probably conspecific. Either identification would make the upper part of the Chisos Fm. of Chadronian age.



## RELATIONSHIPS

No one, to my knowledge, has attempted a comprehensive revision of the North American Brontotheriidae since the monumental work of Osborn (1929). Such a revision is certainly beyond the time or resources available to me. I will therefore only review the information I feel is applicable to titanotheres from the part of the stratigraphic record found in west Texas.

The late Eocene *Sthenodectes* is represented in Whistler Squat l.f. There are two well-preserved skulls of mature individuals with low horns and the dentition or with the alveoli for the teeth. The associated fauna (Wood 1973; Wilson 1974) points to either Bridgerian or early Uintan age. The genotype was described by Douglass (1909) as *Telmatherium? incisivum* from "horizon B about three miles northeast of Well 2, Uinta Basin, Utah." Gregory (1912) made *Telmatherium? incisivum* the type of "a new genus or subgenus *Sthenodectes*." Riggs (1912) added a skull and lower jaws from the same area using the name *Sthenodectes incisivum*. Osborn (1929) retains the genus and says that it is close to *Telmatherium*. *Sthenodectes* has large and molariform premolars. Peterson (1934) described *Sthenodectes priscus* from horizon A, Uintan Eocene. The P<sup>1</sup> on *S. priscus* does not have the internal cusps that are present in *S. australis*.

In 1942 Gazin and Sullivan described a titanotheres from the coastal plain of Mississippi and named it *Notiotitanops mississippiensis*. They remark that "The upper molars are essentially like those of Uintan or even Chadron titanotheres ..." and also discuss the problem of correlating a titanotheres of Uintan or Duchesnean evolutionary stage to the stratum from which it came that contains middle Eocene (Claiborne) invertebrate fossils. A somewhat similar problem bothered me; the molars of *Sthenodectes* from the Whistler Squat l.f. are about the same as those from the Porvenir l.f. of the early Chadronian. It may well be that the occurrence of the "advanced" titanotheres and the middle Eocene invertebrates is not as serious as Gazin and Sullivan had thought. Those measurements that can be compared between *N. mississippiensis* and *S. australis* show that they are very close in size.

The Vieja titanotheres present a more difficult taxonomic problem. Peterson (1931) described a skull and jaws of *Teleodus uintensis*. The genus had been proposed by Marsh and was based on a lower jaw that contained three lower incisors. Although the locality is uncertain it is supposed to have come from low in the Chadron Fm. of Dakota. Lambe (1908) described *Megacerops primitivus* from the Cypress Hills, Saskatchewan, and Osborn (1929) referred it to *Teleodus*. The identification was based on the presence of three incisors in the lower jaw. No skull was known for either *T. avus* Marsh or *T. primitivus* (Lambe), nor for *T. californicus* described by Stock (1935). The latter had either two or three lower incisors. Russell (1934) supported Osborn's transfer of *Megacerops primitivus* to *Teleodus primitivus* (Lambe) on the basis of three lower incisors. Russell, however, did not have associat-

ed upper teeth. Peterson (1931) was the first to describe associated skull and jaws from the Duchesne River Quarry. Scott (1945) gave a supplemental description of the *Teleodus* material and showed a different restoration (Scott 1945, pl. 7) of the same skull figured by Peterson (1931, pl. 22). Scott emphasized the uniqueness of a “. . . large swelling or convexity, in the parietal region, which so conspicuously characterizes this animal.” *T. uin-tensis* is considered now to be a part of the Lapoint l.f. (Anderson and Picard 1972).

Russell (1934) reviewed the fauna of the Cypress Hills and later (Russell 1940) presented additional material but did not attempt a taxonomic revision. He recognized the presence of at least four genera: *Teleodus*, *Bron-tops*, *Menodus*, and *Megacerops*.

Schlaikjer (1935) described *Ateleodon osborni* on a fragmentary symphy-sis and associated M<sub>2</sub>. He emphasized the “apparent great reduction or com-plete loss of the lower canines and incisors.”

Clark and Beerbower (in Clark et al. 1967, p. 56) identified but did not describe *Teleodus* from the Vieja. All of the FMNH collection came from the Porvenir l.f. Clark and Beerbower (in Clark et al 1972, p. 51), however, made the following statement: “We recognize but two genera of titanotheres from the Oligocene of North America: *Menodus* and *Teleodus*. The diagnostic characteristics of the two genera are:

	<i>Menodus</i>	<i>Teleodus</i>
(1)	$\frac{1}{0-2}$	$\frac{1}{3}$
(2)	Horns small to large, subconical to cylindrical or flat in longitu-dinal section.	Horns small, subconical in longi-tudinal section.
(3)	Top of skull always concave up-ward.	Boss on top of male skulls.

I assume that there are among the unstudied specimens from the Por-venir l.f. in the FMNH those with the characters attributed to *Teleodus*. On the other hand, the much smaller collection of titanothere material in poses-sion of the Oklahoma and Texas universities from both the Porvenir and Little Egypt l.f.s. does not have a lower jaw with alveoli for three incisors. In addition, the fragmentary skull from the Little Egypt l.f. is crushed, and I am uncertain of the presence of a boss. At any rate, *Teleodus* is present in the Porvenir l.f. (*vide* Clark and Beerbower in Clark et al. 1967). *Menodus bakeri* Stovall is also present, both of them survivors of the drastic tax-onomic surgery performed by Clark and Beerbower (1967). *Menodus bakeri* seems closely related to *M. heloceras* from the Oligocene Big Sand Draw Sandstone Lentil of the White River Fm. (Emry 1975).



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